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Scenario for imminent prediction of strong subduction-zone earthquake via ocean-floor geomagnetic observation network

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Ionospheric electron enhancement around the focal region has been observed from about 40 min. before the 2011 Tohoku-Oki earthquake (Heki 2011). On the other hand, ground-level geomagnetic variations prior to the earthquake were as not clear (Minato 2011, Utada et al. 2011). A possible mechanism to explain those electromagnetic anomalies was proposed in terms of coupled interaction of earthquake nucleation with deep Earth gases, where the interaction causes a negatively electrified gas flow due to an exo-electron attachment reaction, as the gases pass through fractured asperities (Enomoto 2012). The pressure-impressed current I in the model is expressed as

$\log I = 0.5M + \log (5.1\times10^{2} ken h^{2} D_c/v_i)$ (1),

where e is the electronic charge, n is the density of negatively charged gas molecules, k is a constant of proportionality, M is the earthquake magnitude, h is crack-open gap, v_i is the gas viscosity, D_c is the focal depth. The factor ken could be determined from the laboratory experiments

For earthquake prediction, it is desired to detect clear and identifiable pre-seismic signal. There maybe a possible way to satisfy the condition for subduction-zone earthquake; that is, Fig. 1 showed pre-seismic geomagnetic variation caused by the current estimated from eq.(1) as a function of distance from the epicenter to the geomagnetic observation site with various dip values: the results suggest that clearly identifiable signals attributed to the imminent occurrence of an offshore strong earthquake with a low angle thrust focal mechanism might be observable if geomagnetic measurements are made continuously near the ocean floor epicenter, say within a distance of 20?30 km. Using the observed precursor geomagnetic signals, detected at least three different points on the scenario ocean-floor of subduction-zone earthquake, one could estimate the focal zone (the position of current source), the amount of current, and thus the magnitude. Since both the pre-seismic geomagnetic variation and ionospheric electron enhancement are induced by the same source mechanism, the precursor period might be around several tens minutes as caused by the 2011 Tohoku-Oki earthquake. The net-work observation of geomagnetic fields using submarine cables on the seafloor of scenario subduction-zone earthquake; e.g. the Nankai Trough earthquake, may, therefore, make it possible to predict earthquake occurrence.

References

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